MULTIMEDIA UNIVERSITY®

STUDENT ID NO | | | | | | | | | | |

# MULTIMEDIA UNIVERSITY

# FINAL EXAMINATION

**TRIMESTER 1, 2022/2023 (TERM ID 2215)**

## PEM0016 – ALGEBRA

(Foundation in Engineering)

22 FEBRUARY 2023
2:30 p.m. – 4:30 p.m.
(2 Hours)

---

**INSTRUCTIONS TO STUDENT**

1. This question paper consists of **FOUR (4) pages** including cover page with **FOUR (4) questions** only.
2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided. All necessary working **MUST** be shown.
4. Only **non-programmable** calculator is allowed.

## QUESTION 1 [25 marks]

a. Find the real solution for:

i. $\sqrt{x+1}+2=\sqrt{5x-15}$. (7 marks)

ii. $4^y-2^y-12=0$. (5 marks)

b. Solve the following inequalities and express your answer using interval notation.

i. $3\left|\frac{1}{2}x-1\right|-2>10$. (3 marks)

ii. $\frac{(2x+8)(5-x)}{x^2-2x-3}\geq 0$. (5 marks)

c. If $p=\sqrt{3}+\sqrt{2}$ and $q=\sqrt{3}-\sqrt{2}$, prove that $\frac{1}{p+1}+\frac{1}{q+1}=1$. (5 marks)

## QUESTION 2 [25 marks]

a. Given a piece-wise function below:

$$f(x)=\begin{cases}x^2+1 & ,x<0\\ 2 & ,x=0\\ x+2 & ,x>0\end{cases}$$

i. State the domain for $f(x)$. (1 mark)

ii. Evaluate for $\frac{f(-1)-f(0)+f(1)}{3f(2)}$. (2 marks)

b. Two functions are given as $f(x)=\frac{2x}{2x-4}$ and $g(x)=2+\sqrt{x}$. Do the following:

i. Find the domain for both functions, $D_f$ and $D_g$. (1 mark)

ii. Calculate $\left(\frac{f}{g}\right)(4)$. (2 marks)

iii. Find $(f\circ g)(x)$. (3 marks)

iv. Find $f^{-1}(x)$, and its domain and range. (4 marks)

**Continued...**

**QUESTION 2 [25 marks]**

c. Solve: $3e^{2+3x} - 9e^{6-2x} = 0$. (4.5 marks)

d. A function is given as $f(x) = 2^x$.

i. Draw the $f(x)$ graph and plot the following points when $x = -1$, $x = 0$, and $x = 1$. (2 marks)

ii. Hence, use transformation to graph the following function:

$$h(x) = 2^{-x} + 1$$

Show all stages. Find the domain and range of the function $h(x)$. (5.5 marks)

**QUESTION 3 [25 marks]**

a. For the polynomial function $f(x) = x(x-3)(x-1)^2$, do the following:

i. Determine the graph end behavior. (1 mark)

ii. Find the $x$ and $y$ intercepts of the graph $f(x)$. (3.5 marks)

iii. Determine whether the graph crosses or touches the $x$-axis at each $x$-intercept. (1.5 marks)

iv. Find the turning points which occur at $x = 0.307$, $x = 1$, and $x = 2.443$. (3 marks)

v. Sketch the graph of the function $f(x)$. Label the coordinates for all the turning points, $x$-intercepts, and $y$-intercept. (3 marks)

b. Express $f(x) = \frac{x}{2x^2-5x-3}$ in partial fractions. (5 marks)

c. Given that $x^3 + 2x^2 - 3x + 11$ and $x^3 + x^2 + 9$ give the same remainder when divided by $x - p$. Find the possible value(s) of $p$. (5 marks)

d. The coefficient of the sixth term is 1792 when $(1 + ax)^8$ is expanded in ascending powers of $x$. Find the constant value of $a$. (3 marks)

**Continued...**

**QUESTION 4 [25 marks]**

a. Given that $\begin{bmatrix} 9 & p+q \\ 6 & r+s \end{bmatrix} = 4\begin{bmatrix} q & p \\ r & s \end{bmatrix} - \begin{bmatrix} q & 3 \\ -2r & 2 \end{bmatrix}$, find the values of $p$, $q$, $r$, and $s$. (5 marks)

b. If matrix $A = \begin{bmatrix} -3 & -1 \\ 2 & 1 \end{bmatrix}$ and matrix $E = \begin{bmatrix} 1 & 2-x & 1 \\ 2x & 0 & 3 \\ x & 1 & 1 \end{bmatrix}$, find

i. $|A|A^T$. (2 marks)

ii. the value(s) of $x$ for which $|E| = 0$. (5 marks)

c. Ann, Bin, and Chloe visited a confectionery store.

For a total of RM34, **Ann** bought 1 bag of lollipops, 7 bags of gummies, and 1 bag of dark chocolate.

**Bin** bought 1 bag of lollipops, 1 bag of gummies, and 4 bags of dark chocolate for a total of RM40.

**Chloe** spent RM42 on 2 bags of lollipops, 8 bags of gummies and 1 bag of dark chocolate.

[Hint: Use the variables $x$, $y$, and $z$ for the cost of a bag of lollipops, gummies, and dark chocolate respectively.]

i. Write down a system of three linear equations associates with the current problem. (2 marks)

ii Write the system (from Q4ci) in the matrix form: $AX = B$.

Hence, find out the cost of each confectionery products ($x$, $y$, and $z$) by using the inverse of the coefficient matrix. (11 marks)

**End of Page.**